Geometric optimization of wind farms based on minimization of the Coulomb energy

J Trane + E Jørgensen + M Greiner

\[ \min \sum_{i<j=1}^{N} \frac{1}{d_{ij}} \]

Multirotor turbines + wind farms

A Khamas + K Zhu + M Abkar + M Greiner
Wind-farm modeling + optimization

\[ P_{\text{tot}}(\text{selfish}) = \sum \max \left( P_i(a_i|u_i(a_{-i})) \right) \]

\[ P_{\text{tot}}(\text{cooperative}) = \max \left( \sum P_i(a_i|u_i(a_{-i})) \right) \]
Wind-farm modeling

\[ P = \frac{\rho A}{2} C_P(q) u^3 \]

\[ C_P(q) = \frac{1+q}{2} (1 - q^2) \]
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\[
\min \sum_{i<j=1}^{N} \frac{1}{d_{ij}}
\]
OUTLOOK:
-- Heterogeneous wind rose,
\[
\min \sum_{i<j=1}^{N} \frac{1}{d_{ij}(\theta)}
\]
-- Optimal cable layout,
-- Optimal maintenance: traveling salesman problem.
Multirotor turbines + wind farms

A Khamas
+ K Zhu
+ M Abkar
+ M Greiner
Figure 51: Layout of Horns Rev 1, with turbine naming and wind direction. Source: Niayifar & Porté-Agel [29]
Outlook

Redefining wind energy